

## Arthroscopic Versus Open Acromioplasty for Impingement Syndrome and Partial Thickness Rotator Cuff Tear

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We evaluated the results of the surgery for impingement syndromes and partial thickness tears of the rotator cuff with an average follow-up period of 15 months. One group(group I) of 43 patients, 46 cases underwent arthroscopic subacromial decompression. The other comparable group(group II) of 10 patients, 11 cases underwent open acromioplasty. The average age at operation was 48 years old. Arthroscopic subacromial decompression achieved slightly better pain relief, the range of the active forward flexion, function, strength and the overall score with improvement from the preoperative condition than open acromioplasty. The patient's satisfaction was better in group I as well. Using the UCLA Shoulder Rating Scale, 89% of group I and 82% of group II had good or excellent results. Preservation of the origin of the deltoid during an arthroscopic acromioplasty reduced the postoperative morbidity and made it possible to start rehabilitation sooner and to achieve the better and more predictable results.

**Key Words** : Shoulder, Impingement syndrome, Acromioplasty

### INTRODUCTION

Impingement syndrome is one of the most common cause of pain in the anterior aspect of the shoulder. The treatment of rotator cuff pathology has been continuously evolved since Codman<sup>1)</sup> had first described. Neer<sup>2)</sup> described three stages in the development of impingement: stage I, the reversible stage, in which edema and hemorrhage predominate; stage II, an irreversible state in which

tendinitis and fibrosis predominate; and stage III, characterized by significant tendon degeneration and tearing. After Neer's work<sup>2)</sup> in 1972 clarified the efficacy of the open anterior acromioplasty, it is well proven to provide predictable results, but it is difficult to see the rotator cuff in its entirety unless complete bursectomy and detachment of the deltoid muscle are performed, and then only tears in the bursal surface of the cuff can be seen during open acromioplasty. If the deltoid origin is released to expose the ante-

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rolateral corner of the acromion and subacromial space, meticulous repair is needed. Any weakening of the deltoid mechanism will prolong the postoperative morbidity or impair the final functional result. An arthroscopic acromioplasty can eliminate these problems. With this procedure, both the glenohumeral joint and the subacromial space can be accessible without damage to the deltoid. So far, arthroscopic subacromial decompression has become an accepted treatment for patients with impingement syndrome, even though its use for full thickness rotator cuff tears continues to be controversial. We reviewed the result of arthroscopic subacromial decompression and open acromioplasty to evaluate the efficacy of arthroscopic acromioplasty.

#### MATERIALS AND METHODS

A retrospective review was performed on fifty seven cases of fifty three patients who had undergone either arthroscopic or open acromioplasty at the Shoulder Clinic in Kyung Hee University Hospital from January 1994 through June 1995. All of them had refractory impingement syndrome or partial thickness rotator cuff tear involved less than 50% of the thickness and less than 1cm in length. All patients underwent subacromial decompression by same surgeon (Y.G.R.). Forty-six cases were included in arthroscopic group (group I), and eleven cases were included in open group (group II). In group I, patients who had only the impingement syndrome without the rotator cuff tear were twenty six cases and patients who had partial thickness tears of the rotator cuff were twenty

cases. In group II, impingement syndrome were four and partial thickness were seven. Among partial thickness tears, the bursal side was involved in four patients. The average age was 48 years (range 18-73) and the man/woman ratio was 1.3. Right shoulder was involved in thirty patients, left in nineteen, and both in four. The dominant extremity was involved in sixty percents.

The average duration of symptoms before the acromioplasty was thirty four months. Among these patients, thirty three had symptoms within one year. Most of them had typical anterior shoulder pain, pain with lying on the affected shoulder, subacromial crepitus, subtle loss of range of active motion.

The diagnosis of impingement syndrome was based on the following findings: a history of pain in the shoulder, aggravated by overhead motion of the affected arm, and diminished function of the shoulder, combined with a positive impingement sign. Twenty-nine cases in group I and seven in group II had severe pain, and seventeen in group I and four in group II complained of moderate pain. Pain was scored average 2.8 ranged from 1 to 6 in group I and average 2.3 ranged 1 to 4 in group II by the UCLA system (Fig. 1-2). Preoperative function was evaluated in all patients and scored good, mild limited, moderate limited and markedly limited. Twenty two cases in group I and three in group II had moderate limitation of activity of daily living (Fig. 3-4). Twenty four in group I and eight in group II had a markedly limited activity. Shoulder function was scored average 3.4 ranged from 1 to 6 in group I and average 2.8 ranged from 1

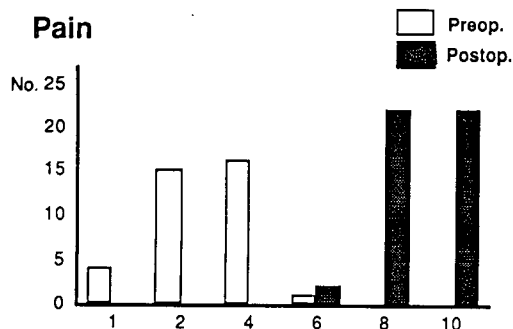


Fig. 1. Comparison of the pre and postoperative pain score in Group I

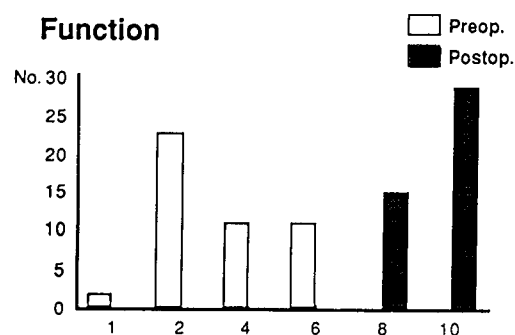


Fig. 3. Comparison of the pre and postoperative function score in Group I

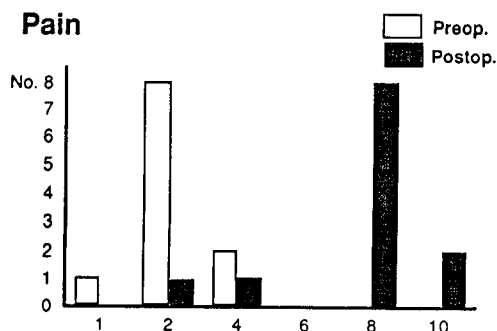


Fig. 2. Comparison of the pre and postoperative pain score in Group II

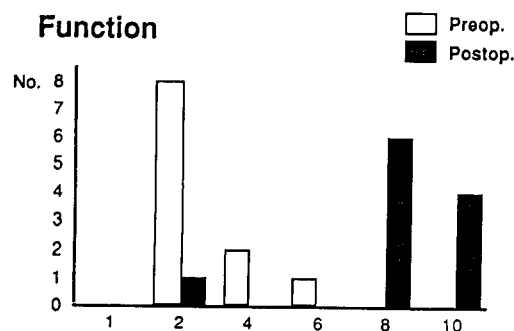


Fig. 4. Comparison of the pre and postoperative function score in Group II

to 6 in group II. Active flexion at the scapular plane was 105 degrees (range 60-180 degrees) due to moderate to severe anterior shoulder pain and active external rotation at the side was 32 degrees (range 0-90 degrees) and some of them complained of the weakness with abduction at the scapular plane.

An impingement sign was performed preoperatively on all fifty three patients. To demonstrate Neer sign, the examiner flexed the patient's shoulder maximally forward with one hand and exerted pressure downward on the acromion with the other hand. Thirty-seven patients in group I and all of group II had a

positive Neer sign. The patients were also tested Hawkins sign for impingement of the rotator cuff against the coracoacromial ligament. The examiner placed the patient's shoulder in 90 degrees of abduction at the sagittal plane and then passively internally rotates it. Thirty five patients in group I and all of group II had a positive Hawkins sign. Thirty six patients in group I and all of group II had a painful crepitus at the anterolateral corner of the acromion with rotating the arm, so called "a positive abrasion sign".

Radiographs were checked for all patients; true shoulder anteroposterior view, caudal 30 degrees view, supraspin-

tus outlet view and axillary view. A characteristic spur on the anterior acromial lip, the coracoacromial ligament, and occasionally spurs on the undersurface of the acromioclavicular joint. Preoperative radiographs of the shoulder showed eight patients with the flat type of the acromion, twenty two with the curved, and sixteen with hooked in group I. In the group II, curved type showed in seven patients and hooked in four.

### OPERATION

Arthroscopic subacromial decompression was done under the general anesthesia in nineteen patients and the interscalene block in twenty seven patients. Open acromioplasty was done under the general anesthesia in seven patients and the interscalene block in four patients. All of them underwent the operation with the beach chair position. Arthroscopic subacromial decompression was performed in five patients among the group I on the base of the out-patient clinic. It took average one hour and fifteen minutes for arthroscopic subacromial decompression, and average one hour and forty-five minutes for the open acromioplasty.

#### Surgical Techniques

##### Open Acromioplasty

Open acromioplasty was performed in beach chair position. An incision 5cm in length over the deltoid with Langer's line from the edge of lateral margin of the acromion to superolateral side of the coracoid process was made. A deltoid splitting incision was created through the anterior raphe using a electrocautery. The anteroinferior acromion was excised along

with the attached coracoacromial ligament using a small osteotome and the undersurface of the anterior acromion was flattened using a motorized burr. The bursectomy was performed after the bursal side of the rotator cuff was examined. After standard acromioplasty was performed, the detached deltoid from the superior acromion was reattached using the nonabsorbable sutures which were passed through the bone of the anterior acromion.

##### Arthroscopic Acromioplasty

Arthroscopic acromioplasty was performed in same position. Arthroscopy of the glenohumeral joint was routinely performed, followed by a standard arthroscopic acromioplasty, while viewing through a posterior portal and resecting through a lateral portal. After the inflamed and thickened subacromial bursa was shaved, electrocautery was used to release the coracoacromial ligament from the lateral to medial along the undersurface of the acromion. The anterior one third of the undersurface of the acromion was then removed with either a shaver or burr in the lateral portal from anterior to posterior and from lateral to medial.

##### Postoperative Rehabilitation

Patients were begun on passive range of motion exercises immediately in the postoperative period; 1) forward flexion at the scapular plane, 2) external rotation at the side, 3) cross body adduction, and 4) internal rotation at the back. Once a patient achieved full range of motion, the patient was allowed to strengthening exercises for the deltoid, the supraspinatus, the infraspinatus and the subscapularis.

laris if patient feel comfortable after three weeks postoperatively. At this time, most patients returned to work and were recommended the activity of daily living at the below level of the shoulder.

## RESULTS

All patients returned for follow-up examination and were clinically reviewed with the UCLA score at 10 to 27 months postoperatively (average: 18.5 months). In group I, postoperative scores for pain increased upto average 8.9 points (range: 6-10 points) from average preoperative score of 2.8 points (range: 1-6 points) (Fig. 1). In group II, postoperative scores for pain increased upto average 7.8 points (range: 2-10 points) from average preoperative 2.3 points (range: 1-4 points) (Fig. 2). The scores for function improved from 3.4 points to 9.1 (range: 8-10) in the group I, while the group II improved from 2.8 points to 7.8 (range: 2-10) (Fig. 3-4). At the last follow up, the active forward flexion at the scapular plane was 167 degrees in the group I, and 163 degrees in the group II. The scores for the range of motion improved from 2.7 points to 4.9 in the group I, and improved from 3.6 points to 4.5 in the group II (Fig. 5-6). The overall scores could be obtained 32.5 points (range: 21-35) from 13.5 (range: 8-23) in the group I, and 30.1 points (range: 25-35) from 12.9 (range: 10-17) (Fig. 7-8). Results were divided into four groups: excellent (34 to 35 points), good (30 to 33), fair (21 to 29), and poor (20 or less points). Forty one of the forty six cases (eighty nine percents) in the group I and nine of the eleven cases (eighty two percents) in the group

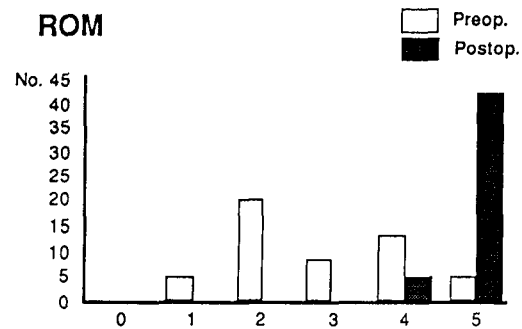


Fig. 5. Comparison of the pre and postoperative ROM score in Group I

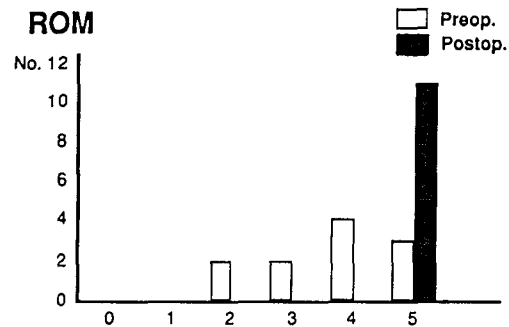


Fig. 6. Comparison of the pre and postoperative ROM score in Group II

II had good or excellent results.

Four patients were dissatisfied with their final outcome, and three were in the group I, one in group II. One patient who was in worker's compensation and had an impingement syndrome combined with stiff shoulder due to greater tuberosity fracture obtained only 22 points after arthroscopic subacromial decompression and capsular release in comparing with preoperative 10 points. This patient still complained of a moderate pain and was unsatisfied with the latest result even though pain and function score increased 6 points from preoperative 2 points and score for range

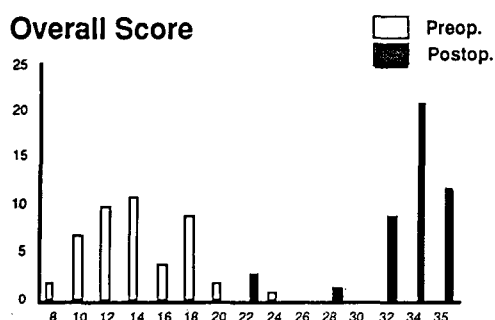


Fig. 7. Overall score in Group I

of motion improved 5 points from 2 points. Two patients who had had partial thickness rotator cuff tear with diabetes mellitus had fair results. One of these underwent the arthroscopic subacromial decompression, and another patient underwent the open acromioplasty. The first patient had 21 points of final score in comparing with preoperative 14 points. The score for pain improved 8 points from 4 points even though the range of motion and function was unsatisfied. The postoperative score for function and for range of motion was 4 points each other, while the preoperative function and range of motion score was 2 and 3 points. The second patient had combined with complete biceps rupture, and tenodesis after arthroscopic resection of the biceps was performed simultaneously at the open acromioplasty. He had a persistent pain (pain score; 4) and was dissatisfied with the surgical procedure, even though postoperative range of motion and function was 8 points and 5 points each other. But the final score of this patient was 22 points, while the preoperative score was 13 points. The other had a partial thickness rotator cuff tear with partial rupture of the biceps tendon

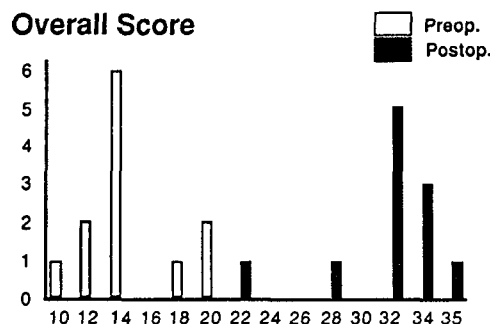


Fig. 8. Overall score in Group II

involved less than 50% thickness, and underwent arthroscopic subacromial decompression. His final score was 22 points from preoperative 10 points and was dissatisfied. He gained 5 points from preoperative 2 points in the score for the range of motion, but the scores for pain and function improved 6 points from 2 points.

One patient experienced paresthesia at the shoulder and upper arm after the interscalene block and this symptom had discontinued 4 months after arthroscopic surgery. This patient eventually obtained a good result and was satisfied with the operation.

## DISCUSSION

The primary goal of surgical intervention for the vast majority of the patients who had a refractory impingement syndrome and partial thickness rotator cuff tear is to decrease pain, including rest pain, night pain and pain with activities of daily living. Additional goals of surgery are to improve shoulder function and to limit the progression of rotator cuff tendinopathy.

Since the anterior acromioplasty had

been recommended by Neer<sup>7</sup>, the overall satisfactory results in most reviews were 70% to 90% with open acromioplasty<sup>5,9,10,12,14</sup>. Hawkins and Adams<sup>5</sup> reported on 108 open acromioplasty with intact rotator cuff and there was an overall success rate of 86 percent relating to pain relief. They described that patients who exhibited a decreased range of motion preoperatively and patients with neck pain preoperatively accounted for a higher percentage of failures. Neer<sup>7</sup> stressed the importance of a secure reattachment of the deltoid to the anterior acromion. He recommended repair to the remaining deltotrachezius fascia while others have utilized sutures passed through the bone of the anterior acromion. Rockwood and Lyons<sup>10</sup> modified this technique to include removing the entire portion of the acromion anterior to the AC joint as a guide to the extent of anterior acromion resection. They reported 89% good and excellent results after modified acromioplasty for patients who had had intact rotator cuffs. However, the complications of open acromioplasty include problems of the deltoid detachment or avulsion from the reattachment to the remaining acromion and resultant scarring in the subacromial space. In an attempt to avoid these problems associated with open acromioplasty, the technique of arthroscopic acromioplasty<sup>2</sup> was developed and the theoretical advantages of this procedure were decreased patient morbidity, out-patient or one day surgery, avoidance of problems associated with deltoid detachment, and the ability for intra-articular inspection of the joint and undersurface of the rotator cuff. The surgical technique is demanding, is associated with

a considerable learning curve, and has its own potential for problems. But, published reports<sup>3,4,13</sup> have been encouraging and many surgeons currently employ this method for the treatment of all patients with unresponsive stage II impingement. Ellman and Kay<sup>3</sup> reported on arthroscopic subacromial decompression for chronic impingement. At two to five year followup, 89% of the cases in their study achieved a satisfactory result. Gartsman et al.<sup>4</sup> described his results after arthroscopic acromioplasty and no significant difference was noted between patients with an intact cuff and those with a partial cuff tear. But the results were noted to be worse in those patients with full thickness cuff tears. Speer et al.<sup>13</sup> reported 88% good and excellent results after arthroscopic acromioplasty for patients with intact rotator cuffs. Lazarus et al.<sup>6</sup> reviewed their results comparing open and arthroscopic acromioplasties with stage II impingement and partial rotator cuff tears and reported there were no statistical difference between the groups in mean postoperative shoulder scores. But 87.5% of patients were satisfied in open surgery, whereas in arthroscopic surgery, 76.7% were satisfied. They noted calcification might be associated with a worse result. Sachs et al.<sup>11</sup> documented that there were no significant differences in results of open and arthroscopic acromioplasty at 1 year, with 21 of 22 (95%) open patients and 17 of 19 (90%) arthroscopic patients evaluating themselves as moderately or completely improved. Of these totals, 68% of arthroscopic and 59% of open patients were completely improved.

In our study, there was an ascendancy

of good and excellent results in arthroscopic acromioplasty group. Concerning the pain relief and function improvement, the arthroscopic group achieved a slight better and more predictable result than the open group. In arthroscopic group, the scores for postoperative pain ranged 6 to 10 points, whereas ranged 2 to 10 points in open group. The final outcome for function was good or excellent in all of patients who underwent arthroscopic surgery, however it was so variable in open group. There was no significant difference in the postoperative active forward flexion at the last follow up as compared with each group. Two patients who had had biceps lesion had 22 points postoperatively both in arthroscopic and open surgery. The presence of biceps lesion might be the adverse effect on outcome.

In conclusion, both arthroscopic and open acromioplasty can lead to excellent results in the majority of patients who had a refractory impingement syndrome and partial thickness tear of the rotator cuff, but arthroscopic acromioplasty was associated with better and more predictable results. Preservation of the origin of the deltoid during the arthroscopic acromioplasty reduced the postoperative morbidity and made earlier rehabilitation and better results.

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## 충돌증후군 및 회전근개부분파열에서의 관절경적 견봉성형술과 개방적 견봉성형술의 비교 분석

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저자들은 1994년 1월부터 1995년 6월까지 충돌증후군 및 회전근개부분파열에 대하여 관절경적견봉성형술과 개방적 견봉성형술을 시행하여 이에 대한 결과를 비교 분석하였다. 대상 환자는 총 53명으로 관절경적 견봉성형술을 시행한 환자(제 1군)는 43명으로 46례였으며, 개방적 견봉성형술을 시행한 환자(제 2군)는 10명으로 11례이었다. 평균 추시기간은 18.5개월(10-27개월)이며, 수술 당시의 평균 연령은 48세(18-73세)였다. 수술후 치료결과에 대하여 분석한 결과 제 1군에서 제 2군보다 동통의 감소, 능동적 상지 거상 범위, 기능적인 면, 근력 그리고 술전 및 술후 측정된 견관절의 총괄적 점수의 향상에 있어서 우위를 보였다. 또한 환자의 만족도에서도 제 1군이 높았으며, UCLA 견관절 평가 지수에서도 제 1군은 89%, 제 2군은 82%로 약간의 높은 점수를 보여 주었다.

이와 같은 결과는 관절경적 견봉성형술이 개방적 견봉성형술에 비해 삼각근의 기시부를 보존함으로써 술 후 이환율을 줄이고, 또한 물리치료를 적극적으로 조기에 시작할 수 있는 잇점이 있어 더욱 좋은 결과를 얻을 수 있었으리라 사료되는 바이다.

**핵심단어** : 견관절, 충돌증후군, 견봉성형술